erature" which is a measure of comfort based on temperature and humidity. This is the term we call THI (Temperature – Humidity Index) and is computed by the following equation, adapted from one described by E. C. Thom, 1957:

$$THI = 0.4\ (T_d + T_{wb}) + 4.7778$$

where: T_d = Dry Bulb Temperature (°C)
T_{wb} = Wet Bulb Temperature (°C)
THI is in degrees Celsius

It has been empirically determined that a majority of people will be uncomfortable by the time this figure reaches 24 °C.

Isopleths of the 1% and 99% levels of air temperature have been selected to present extreme conditions.

The graphs show air temperature versus wind speed. Use may be made of these charts to determine the extent of discomfort likely because of extreme heat or cold. They may also be used to estimate the likelihood of superstructure icing.

Ice accretion is a complicated process that depends upon sea conditions, temperature, wind and the size and behavior of the ship. Superstructure icing affects all ships but is more dangerous for smaller vessels. Icing potential exists when the air temperature falls below the freezing temperature of sea water (usually about −2 °C) with the wind equal to or greater than 11 knots. The lower the temperature and higher the wind speed, the greater the potential for superstructure icing and it may become quite severe with temperatures ≤ −9 °C and wind ≥ 34 knots.

SEA SURFACE TEMPERATURE

Sea surface temperature is an element which is recorded with a fairly high frequency in marine observations. The 1% and 99% isopleths give qualitative estimates of the extremes that may be encountered at any location.

Note that the temperature range on the cumulative percent frequency graphs may vary from area to area and month to month. Also, the scale changes to larger intervals on some graphs because of the larger range encountered in areas where warm and cold ocean currents are in close proximity.

The mean sea surface temperature may be used to estimate the approximate time a man in ordinary clothes and life preserver may be expected to survive if washed overboard:

Water Temperature	Exhaustion or Unconsciousness	Expected Time of Survival
< 0 °C	< 15 min	< 15 to 45 min
0-5 °C	15-30 min	30 to 90 min
5-10 °C	30-60 min	1 to 3 hrs
10-15 °C	1-2 hrs	1 to 6 hrs
15-20 °C	2-7 hrs	2 to 40 hrs
20-25 °C	3-12 hrs	3 to indefinite hrs
> 25 °C	Indefinite	Indefinite

HUMIDITY

Moisture content of the atmosphere is another element which is recorded relatively infrequently in observations taken by transient ships. It is, however, recorded on nearly all of the OWS observations. The dew-point temperature analyses on this chart are keyed to the means computed at the OWS's.

The 1% and 99% dew-point temperature isopleths give qualitative estimates of extremes of this element that may be encountered at any location.

The cumulative percent frequency of wet-bulb temperatures may be read along the solid line with values on the scale at the top of the graph. The cumulative percent frequency of relative humidity may be read along the dashed line with values on the scale at the bottom of the graph.

PRECIPITATION

The treatment of the data with respect to precipitation type has been changed from the previous atlas. Instead of percent frequency of present weather observations reporting frozen precipitation which included freezing drizzle and freezing rain along with snow, in this volume the percent frequency of *precipitation* observations reporting *snow* is given. Freezing rain and freezing drizzle are not considered to be "frozen" precipitation since the moisture freezes after it falls.

In an effort to bring the percent frequencies of precipitation as reported by OWS's and transient ships more in line, present weather codes 20-27 (precipitation within the past hour) were counted in the precipitation totals for the transient ships. The graphs for the representative areas were computed from these revised data.

The percent frequency of all observations reporting precipitation is printed in the upper right corner of each graph. The bar graph gives the percent frequency of precipitation which occurs with each wind direction or calm. The reader is reminded that this graph is based on precipitation frequency and not on wind direction frequency. If the reader is interested in determining the percent frequency of winds from any direction, he should refer to the surface wind chart.

VISIBILITY

The cumulative percent frequency of horizontal visibility is presented by nautical mile class intervals rather than by kilometers. The percentage of horizontal visibility equal to or greater than 25 nautical miles can be obtained by subtracting from 100% the cumulative percent frequency at the point < 25 on each graph. Caution is advised, however, in interpreting these areas since, because of curvature of the earth, it is virtually impossible to see 25 miles horizontally from the bridge of most ships. The supplemental table at the bottom of the graph gives percentage of visibilities < 2 nautical miles which occurred with each wind direction and calm.

CLOUD COVER

In the previous atlas series the confidence level of low cloud amount statistics was deemed to be quite low. This was because of a number of reasons, one of the main ones being the extremely low frequency of recording of this element. In the present atlas, because of the increased data base, the reliability of low cloud data has improved. The total cloud amount element does not suffer from this deficiency to so great an extent. The number of observations available which contain only total clouds amount continues to be higher than those containing both low and total.

In the analysis of these data, the OWS's were used as benchmarks. Cloud patterns derived from the marine observations and those depicted by satellites show fairly close agreement (U.S. Department of Commerce and United States Air Force, *Global Atlas of Relative Cloud Cover, 1967-70,* Washington, 1971).

The observation count on the graphs is that of obser-